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LONG-TERM STORAGE OF YELLOW AND PAPER BIRCH SEED

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ABSTRACT.--Storage of yellow and paper birch seeds for 12 years does not appear practical but seed viability can usually be maintained for at least 8 years, if the seeds are kept in closed containers at 36° to 40° F.

OXFORD: 181.524:232.312.3:232.315.2:176.1 *Betula* spp. KEY WORDS: *Betula alleghaniensis* Britt., *B. papyrifera* Marsh., viability, germination, variation.

Only a few studies have been conducted regarding the storage life of yellow birch (*Betula alleghaniensis* Britt.) and of paper birch (*B. papyrifera* Marsh.) seeds, which actually are winged nutlets. Joseph (1929) reported that the viability of seeds from both species decreased after 1 year of storage at room temperature. Redmond and Robinson (1954) found that yellow birch seed remained viable after 27 months of storage at 32° F. Earlier, it was reported that a single previously untested lot of yellow birch seed had a germination percentage of 44 percent after being stored for 12 years at 40° F (USDA Forest Service 1948). However, storage of yellow and paper birch seed for periods as long as 12 years does not appear practical, based upon data derived from the study being reported here.

STUDY PROCEDURE

During the fall of 1960, 24 seed lots representing individual trees (12 each from yellow and paper birch trees) were collected and dried at room temperature for a week or more and then placed in tightly closed bottles for storage at temperatures ranging from 36° to 40° F. Most of the lots were given germination tests during December 1960 and January 1961 by placing 100 unstratified seeds from each lot on moist perlite in petri dishes, which were kept in a greenhouse at about 70° F for 30 days (the customary period used for birch germination tests). Similar tests were conducted in 1964 (Clausen 1965), in 1968 (Clausen 1970), and again in 1973. Beginning in 1964, the natural daylight conditions in the greenhouse were extended using fluorescent and incandescent lighting to 20 hours, which obviates the need for stratification of the seed. Otherwise, the series of

germination tests during 1964, 1968, and 1973 were conducted as described for the December 1960 through January 1961 tests.

In addition, eight more seed lots (four each of yellow and paper birch) were collected in the fall of 1964 and stored with the 1960 seed lots under identical conditions. These eight seed lots were tested as above in December 1964, in December 1968, and in February 1973.

RESULTS

After increasing to 60.6 percent in 1964, the average germination of the yellow birch seed lots decreased to 26.4 percent in 1968 and to 11.8 percent in 1973 (table 1). Between 1968 and 1973, only two seed lots showed little or no change in viability; one lot decreased one-half; four lots showed large reductions in viability; and four lots lost all viability. One lot became inviable between 1964 and 1968.

Germination of the paper birch seed lots increased to an average of 78.4 percent in 1964, but declined to 31.5 percent in 1968 and to 12.0 percent in 1973. Only one seed lot had as good germination in 1973 as it had in 1968, two lots decreased to about one-half of their 1968 germination, and three lots showed greater declines. Although six lots were inviable by 1973, one of these had lost its viability by 1968.

Only two seed lots of yellow birch and three of paper birch had a satisfactory germination percentage of 30 percent or higher after 12 years of storage. Three of these still had high germination percentages (71 to 81 percent) after 8 years of storage, whereas paper birch lot 1904 had fairly low germination in 1968. Yellow birch lot 1900-4 had 65 percent germination in 1968 and showed no change in the 4-year interval. Most of the seed lots that lost all viability had low germination percentages after 8 years of storage.

Table 1.--*Germination percentage after 30 days; yellow and paper birch seed collected in 1960.*

Tree number	Jan. 1961	Nov. 1964	Dec. 1968	Feb. 1973
YELLOW BIRCH				
1899-1	21	33	31	2
1899-2	5	16	8	2
1899-3	15	46	12	11
1899-4	10	55	8	0
1899-5	84	87	82	41
1900-1	70	81	68	18
1900-2	81	98	3	0
1900-3	61	72	5	0
1900-4	49	85	65	65
1900-5	24	26	2	0
1900-6	21	63	0	0
1900-7	21	65	33	2
Average	39.3	60.6	26.4	11.8
PAPER BIRCH				
1802-S [1/]	58	79	72	34
1802-N [1/]	--	83	71	38
1903-1	1	86	31	8
1903-2	53	87	7	0
1903-3	46	81	18	0
1903-4	57	85	17	0
1903-5	31	42	2	0
1903-6	29	69	0	0
1904	6	78	27	33
1905 [2/]	48	99	52	17
1946-G [2/]	--	76	52	14
1946-T	--	76	29	0
Average	36.6	78.4	31.5	12.0

1/ *Seed from two separate stems of same tree.*

2/ *Lot G collected from ground, Lot T from tree itself.*

CONCLUSIONS

The viability of the seed lots after 12 years of storage appears to be related to their viability after 8 years of storage. However, viability after 8 years appeared unrelated to viability after 4 years, which points up that individual seed lots vary greatly in how rapidly they lose their viability (Clausen 1970).

This variation in storage life of yellow and paper birch was reflected in the data derived from the seed lots collected in 1964. Although the average

germination of the 1964 yellow birch lots after 4 years of storage was only about half as good as when fresh, it increased to about the original level after 8 years of storage (table 2). One lot had much better germination in 1973 than it had in 1964. Germination of two of the paper birch seed lots decreased slightly; in the other two, it increased considerably between 1968 and 1973--thus, the average germination was somewhat better in 1973. One of these lots also had much better germination in 1973 than in 1964.

Table 2.--*Germination percentage after 30 days; yellow and paper birch seed collected in 1964.*

Tree number	Dec. 1964	Dec. 1968	Feb. 1973
YELLOW BIRCH			
3290-3	43	16	27
3290-4	29	19	24
3290-5	55	24	57
3290-6	70	37	83
Average	49.2	24.0	47.8
PAPER BIRCH			
3225-1	82	44	40
3225-2	83	86	80
3225-3	59	44	75
3225-4	73	14	26
Average	74.2	47.0	55.2

The fact that none of the original 24 seed lots decreased, and most increased, in viability during the first 4 years of storage is of biological significance and of practical importance to growers of birch planting stock. No definite reason for the increased germination was discovered, but the following circumstances may have had some effect. Seed of paper birch tree No. 1903-1 showed the largest increase in germination--from 1 to 86 percent. The seed was collected earlier from this tree than from the five other trees in the same stand and may not have been fully ripe at the time of collection. The storage allowed time for after-ripening of the seed and could have provided proper conditions for overcoming any embryo dormancy present in the seed. This could conceivably account for some of the increased viability of other lots as well. The long-day treatment the seed lots received in 1964 and in subsequent tests, but not in 1961, could also have increased the germination percentages, because long photoperiods are known to promote germination of unstratified birch seeds (Vaartaja 1959). However, there are no obvious explanations why certain seed lots of the second set of samples had better germination after 8 years of storage than they did after 4 years of storage.

Although a few seed lots showed satisfactory germination after 12 years of storage, such long-term storage of yellow and paper birch seed does not appear practical. In general, viability begins to decline after 4 years. However, storage of seeds of these species for up to 8 years is possible, but individual lots should only be used following germination tests because of the great variability in their storage life.

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